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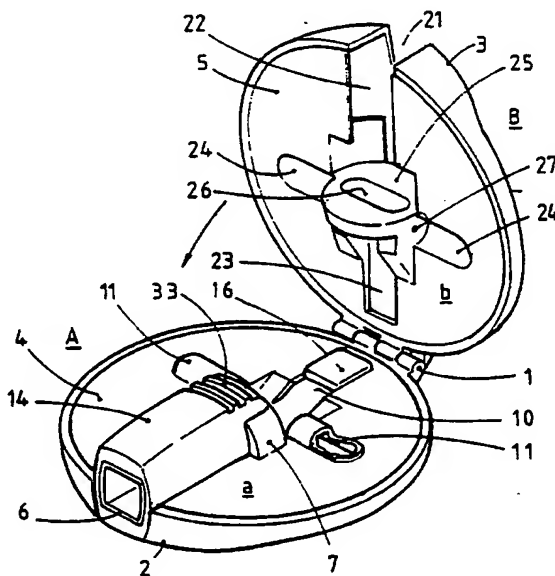
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: A DEVICE FOR USE WITH THE INHALATION OF POWDERED MATERIALS CONTAINED IN ROD-SHAPED CAPSULES

(57) Abstract

The invention relates to a device for use with the inhalation of powdered materials contained in rod-shaped capsules, having two parts (2, 3) which may be pivoted one relative to the other, and provided with a mixing chamber (7) having substantially tangentially directed air inlet openings, said mixing chamber having one end in communication with a mouth piece (6) and the other end in communication with a capsule receiving cavity (26), the latter being formed in conformity with the longitudinal sectional shape of a capsule and having at least one longitudinal end a passage opening (27) for a transversely (= in the longitudinal direction of the capsule receiving cavity) reciprocating piercing needle, and wherein the part (2) of the device comprising the mouth piece (6) is mounted to pivot relative to the capsule receiving cavity comprising part (3) of the device between a closed ready for use-position and an opened position permitting the insertion of a capsule. In accordance with the invention the mouth piece (6) is integrally formed with the mixing chamber (7), whereas the capsule receiving cavity (26) is provided in a bottom section (25) which closes the mixing chamber (7) in the closed or ready for use-position and is making part of said other part (3) of the device.



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Title: A device for use with the inhalation of powdered materials contained in rod-shaped capsules.

The invention relates to a device for use with the inhalation of powdered materials contained in rod-shaped capsules, of the type, comprising a mixing chamber having substantially tangentially directed air inlet openings, said mixing chamber having one end in communication with a mouth piece and the other end in communication with a capsule receiving cavity, the latter being formed in conformity with the longitudinal sectional shape of a capsule and having at at least one longitudinal end a passage opening for a transversely (= in the longitudinal direction of the capsule receiving cavity) reciprocating piercing needle, and wherein the part of the device comprising the mouth piece is mounted to turn relative to the capsule receiving cavity comprising part of the device between a closed ready for use-position and an opened position permitting the insertion of a capsule.

Such devices are already known in various embodiments. A typical example of such a well-known device is disclosed in NL-A-176837 and NL-A-179345.

With this well-known device the mouth piece comprising part of the device is rotatably mounted - about an axis that is positioned excentrically to its longitudinal axis - relative to the other part of the device, which comprises the mixing chamber, the capsule-receiving cavity and the piercing needle(s).

The insertion of a capsule in the receiving cavity is rather difficult, because this is to take place via the end of the mixing chamber facing the mouth piece. The removal of an emptied capsule may also be difficult.

Another typical example of a well-known device of the type above referred to is disclosed in EP-A-0041783. With this well-known device the mouth piece is forming a part which may be removed from the rest of the device, so that the device may be loaded with a fresh capsule and an emptied capsule may be removed therefrom by taking the mouth piece off. Moreover there are provisions with this well-known device to jammingly hold a capsule within the receiving cavity. For this purpose the walls of the capsule receiving cavity are provided with ribs. The piercing of the capsule is effected automatically when the device is closed by placing the mouth piece, whereby the mouth piece actuates the piercing needle(s) and moreover - upon retraction of the piercing needle(s) - actuates an ejecting member. This means that when

the device is closed upon placing a capsule, the latter will be automatically pierced and then, for direct use, ejected into the mixing chamber. Thus the closed position is also the use-position. Consequently it is not possible to place a capsule for later use i.e. to  
5 postpone piercing of the capsule until the moment at which the device is actually used.

The invention aims at providing an improved device of the type under consideration.

In accordance with one aspect of the invention an inhalation  
10 device of the type defined in the first part of claim 1 and disclosed in NL-A-176837 (vide also NL-A-179345) is provided, which is characterized in that the mouth piece is integrally formed with the mixing chamber, whereas the capsule receiving cavity is provided in a bottom section which closes the mixing chamber in the closed or ready for  
15 use-position and is making part of said other part of the device. As a result of this the accessibility of the receiving cavity has been improved, so that a capsule can now be easily put into its seat. Moreover cleaning has become easier.

In accordance with a second aspect of the invention an inhalation  
20 tion device of the type defined in the first part of claim 2 and disclosed in EP-A-0041783 is provided, which is characterized in that the mouth piece consists of two sections, one of which forming part of one of the movably connected body parts and the other of which being mounted for a sliding movement relative to said first section between  
25 between a retracted, inactive position and an extended active position, wherein the second mouth piece section is carrying the piercing needle(s) and the ejecting member, whereas the body part containing the capsule-receiving cavity is mounted such that it can be moved into its closed position and from the latter position in the  
30 opened position only when the mouth piece is taking its retracted position.

In this embodiment, when the mouth piece is in its retracted position, it is possible to place a capsule into the receiving cavity for later use and then close the device without the capsule being  
35 pierced. The piercing will be effected only when the user actually wishes to use the device. For that purpose the user will have to extend the mouth piece so as to be able to take it into his mouth, thereby automatically effecting the piercing of the capsule and the ejection of the latter into the swirl chamber. Furthermore it can not

occur that an inhalation attempt is made with a non-pierced capsule within the swirl chamber, such as e.g. with the device according to NL-A-176837.

In accordance with a further feature of the invention the two  
5 parts of (the body of) the device are connected about an axis that is located in a center plane of the mouth piece on that side of the mixing chamber that is turned away from the free mouth piece end, and directed perpendicularly to the longitudinal axis of the mouth piece.

Due to this the device of the invention has in principle  
10 obtained the character of an easily openable and closable box. The manner of using the inhalation device of the invention has thus become more simple, and is now of a rather "natural" character.

The invention will be hereinafter further explained by way of example with reference to the drawing.

15 Fig. 1 is a perspective view of the inhalation device according to the invention, in the opened position and with the mouth piece in its retracted position;

fig. 2 is a view as shown in fig. 1, but with the composing parts in a deassembled state;

20 fig. 3 is a cross-sectional view of the device in the closed position, along the vertical midplane;

fig. 4 is a cross-section along the line IV-IV in fig. 3;

fig. 5 is a cross-section along the line V-V in fig. 3;

fig. 6 is a cross-sectional view of a detail; and

25 fig. 7 is a front view on true scale of the inhalation device in its closed position.

The inhalation device shown in the drawings comprises two parts A and B, which are pivotally connected about an axis 1. These two parts may be closed in the arrow direction from the opened position  
30 shown in fig. 1 to form a relatively flat box.

The parts A and B each comprise a circular shell 2 and 3 respectively, containing a filling a and b respectively.

The two fillings a and b, which together constitute the proper  
35 inhalation device, will be hereinafter further described with reference to the further figures of the drawings.

The filling a is formed by a circular support plate 4, which is integrally formed with a mouth piece section 6 and a substantially flat-cylindrical mixing and swirl chamber 7 connected with the latter; in the assembled position the support plate just fits within the

circumferential edge of the shell 2.

The axis of the mouth piece section 6 and the chamber 7 connected therewith coincides with a center line laying in the upper surface of the support plate 4 and directed at right angles to the pivot axis 1, whereas the terminal edge 8 of the chamber 7 turned away from the upper portion of the mouth piece section 6 is located in a plane which passes through the centre of the support plate and is directed at right angles to said center line.

The terminal edge 8 has a portion which is located under the support plate 4 and is extended towards the pivot axis 1 to form an arcuate support means 8a (vide fig. 3) for a bottom section which has still to be described and is making part of the filling b of the part B.

A perforated partition 9 is provided between the mouth piece section 6 and the chamber 7. At two diametrically opposed locations of the circumferential wall of the chamber substantially tangentially directed air inlet passages 30 are provided, which correspond with air inlet openings 31 provided in the shells 2 and 3 (vide fig. 5, 2 and 7).

Behind the chamber 7 the support plate 4 is recessed up to adjacent the circumferential edge of the plate, at 10. Guide ways 11 are extending at right angles from the two longitudinal edges of the recess 10 and are adapted to receive block-shaped needle carriers 12 (vide fig. 2) and to guide these carriers in the transversal direction. The guide ways 11 are formed by upwardly directed bulgings of the support plate 4.

On the inner mouth piece section 6 which is fixedly connected to the support plate 4, there is provided an outer mouth piece section 14, which may slide on the mouth piece section 6 between a retracted position (fig. 1 and 3) and an extended or active position. For this purpose a slot 13 is cut in the support plate 4 on both sides of the fixed mouth piece section 6, while the outer mouth piece section 14 is projecting with its lower portion through a corresponding recess 15 of the shell 2. The outer mouth piece section is provided with rearwardly extending lower and upper finger grip tongues 32 and 33 respectively (fig. 3 and 5), which abut - in the retracted position of the mouth piece section 24 - against the cross edge of the recess 15 in the shell 2 and against the cross edge of a similar, still to be described recess in the shell 3 (fig. 3) respectively. In the

retracted position the outer terminal edges of the inner and outer mouth piece sections 6 and 14 are laying in a common plane within the outer circumference of the shell 2.

An ejecting tongue 16 is connected with the outer mouth piece section 14 (vide fig. 2) which is located within the rearward part of the recess 10 (adjacent the pivot axis 1) of the support plate 4 when the mouth piece is in its retracted position and which will be moved through the slot 10 forwardly when the outer mouth piece section is moved into its extended position. The ejecting tongue 16 is connected to the outer mouth piece section 14 by means of a connecting yoke 17 (vide fig. 2) that, in the assembled state of the device, is located under the support plate 4 and for this reason is provided slightly under the horizontal center plane of the mouth piece section 14. When formed of plastics material the connecting yoke 17 may resiliently bend relative to the mouth piece section 14 in a sufficient degree to enable it to be assembled with the support plate 4.

As shown in fig. 2, guide grooves 19 are provided in the upper surfaces of the legs 18 of the connecting yoke and guide pins 20 which project from the lower side of the needle carriers 20 are engaging into these grooves.

The filling b of the part B comprises a substantially circular support plate 5 which - in the assembled state - just fits within the circumferential edge of the shell 3 and which is provided with a slot 22 that corresponds with the slot 21 in the shell 2 to accommodate the upper portion of the outer mouth piece section 14 that projects upwardly from the support plate 4 of the part A. The support plate 5 is also provided with a slot 23 that corresponds with the slot 10 in the support plate 4, and with recesses 24 for accommodating the bulgings of the support plate 4 which constitute the guideways 11 for the needle carriers.

The support plate 5 is integrally formed with a bottom section 25 serving to close the rear side of the mixing chamber 7 in part A when the device is in its closed position. The bottom section 25 has an end face that is turned away from the pivot axis 1 and engages the terminal edge 8 of the chamber 7. This end face is forming a part of a cylindrical surface about the pivot axis 1. Furthermore - in the closed position of the device - the bottom section 25 is engaging the rearwardly extending supporting portion 8a of the mixing and swirl chamber 7. A cavity 26 is provided in said end face of the bottom

section 25, which cavity is shaped to conform to the longitudinal section of a rod-shaped capsule having rounded ends. On the wall of the cavity 26 pressure points are formed by ribs 35 (fig. 3 and 4) which extend in the capsule-inserting direction and provide for a slightly jamming seat for the capsule C in the cavity 26. The longitudinal axis of the cavity 26 extends diametrically relative to the bottom section 25 and parallel to the pivot axis 1. In the closed position of the device this longitudinal axis coincides with the common axis of the piercing needles carried by the blocks 12 in the guideways 11. Passage openings 27 for the piercing needles 28 are provided in the spherical end walls of the cavity 26 and positioned on said longitudinal axis. As seen in the rearward direction the cavity 26 merges into a passage slot 40 for the ejecting tongue 16 described hereinabove.

The device described hereinabove is also adapted to contain a supply of capsules. For this purpose in principle all that space within the closed shells 2 and 3 is available, which has not yet been taken by the mouth piece sections, the mixing chamber, the bottom section and the needle carriers. In those zones of the superimposed support plates 4 and 5 which are not covered by the latter parts, recesses may be provided, the form of which corresponds with the longitudinal sectional shape of the capsules. A respective detail is shown in fig. 4, where a supply capsule C' is received in a broad-dimensioned recess 36 of the support plate 4 and held jammed therein by ribs 37 projecting from the edges of said recess. The capsule is supported on a cross rib 38 provided on the inner side of the shell 2, which rib may - after the part B being opened - act as a tilting rib and thus facilitate the removal of the capsule (vide fig. 6).

The preferred inhalation device shown in the drawings forms - in its closed and retracted position - a rather compact and flat article, the size of which hardly goes beyond that of a classic pocket watch or powder compact, so that it may be put away in the user's clothing in a comfortable manner. The actions to be performed for using the device hardly require instructions. The opening of the "box" and the insertion of a capsule may be considered as natural actions and the same applies for the act of taking the finger grip tongues 32 and 33 between thumb and index finger to extend the mouth piece so as to take the latter into the user's mouth.

When extending the mouth piece the capsule ends are automati-



cally pierced. With reference to fig. 2 it will be understood that substantially halfway of the extension movement - when the guide pins 20 of the needle carriers 12 will be positioned in the inwardly directed curves of the guideways 19 - the needles 28 are completely  
5 inserted and that these needles will thereafter - when the extension movement is continued - be retracted from the capsule ends. In the final phase of the extension movement, when the needles have already been retracted from the capsule, the ejecting tongue 16 will pass through the passage slot 40 in the bottom section 25 to eject the  
10 pierced capsule from the bottom section 25 into the mixing chamber 7.

The rather flat shape facilitates the handling during inhaling, whereby the wall portions extending laterally from the extending mouth piece constitute an abutment surface for the user's lips and thus contribute to an optimal use.

15 For the rest the operation during inhaling corresponds to that of the well-known device. Air from the surrounding atmosphere is sucked through the tangential air inlet passages into the chamber 7 and causes the capsule to turn around within the chamber, whereby the powdered material is expelled from the capsule and is mixed with the  
20 air within the chamber 7, so that an air-powder mixture is breathed in by the user.

The device described hereinabove may be suitably formed of plastics material.

C L A I M S

1. A device for use with the inhalation of powdered materials contained in rod-shaped capsules of the type, comprising a mixing chamber having substantially tangentially directed air inlet openings, said mixing chamber having one end in communication with a mouth piece  
5 and the other end in communication with a capsule receiving cavity, the latter being formed in conformity with the longitudinal sectional shape of a capsule and having at at least one longitudinal end a passage opening for a transversally (= in the longitudinal direction of the capsule receiving cavity) reciprocating piercing needle, and  
10 wherein a part of the device that comprises the mouth piece is mounted to turn relative to a capsule receiving cavity comprising second part of the device between a closed ready for use-position and an opened position permitting the insertion of a capsule, characterized in that the mouth piece is integrally formed with the mixing chamber,  
15 whereas the capsule receiving cavity is provided in a bottom section which closes the mixing chamber in the closed or ready for use-position and is making part of said second part of the device.
2. A device for use with the inhalation of powdered materials contained in rod-shaped capsules, comprising a body with two parts  
20 mounted to be moved one relative to the other and provided with a mixing chamber having tangentially directed air inlet openings, said mixing chamber having one end in communication with a mouth piece and the other end in communication with a capsule receiving cavity, said cavity being formed in conformity with the longitudinal sectional  
25 shape of a capsule and being adapted to jammingly hold a capsule, at least one longitudinal end of said cavity having a passage opening for a transversally (= in the longitudinal direction of the capsule receiving cavity) reciprocating piercing needle, an ejecting member being provided which is mounted to be moved into the receiving cavity  
30 to urge a capsule from said cavity into the mixing chamber and wherein the mouth piece is mounted to be moved relative to the capsule receiving cavity comprising part between a closed position and an opened position permitting the insertion of a capsule and wherein the mouth piece is provided with means adapted to first actuate the  
35 piercing needle(s) and then the ejecting member when said mouth piece is moving into a use position, characterized in that the mouth piece consists of two sections, one of which forming part of one of the movably connected body parts and the other of which being mounted for

a sliding movement relative to said first section between a retracted, inactive position and an extended active position, wherein the second mouth piece section is carrying the piercing needle(s) and the ejecting member, whereas the body part containing the capsule-receiving cavity  
5 is mounted such that it can be moved into its closed position and from the latter position into the opened position only when the mouth piece is taking its retracted position.

3. A device according to claim 1 or 2, characterized in that the two parts of (the body of) the device are connected about a pivot axis  
10 that is located in a center plane of the mouth piece, substantially perpendicular to the longitudinal axis of the latter and positioned on that side of the mixing chamber that is turned away from the free mouth piece end.

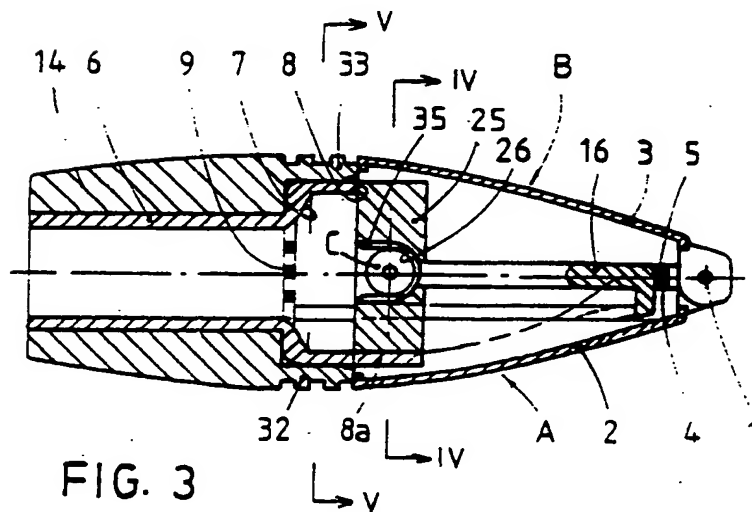
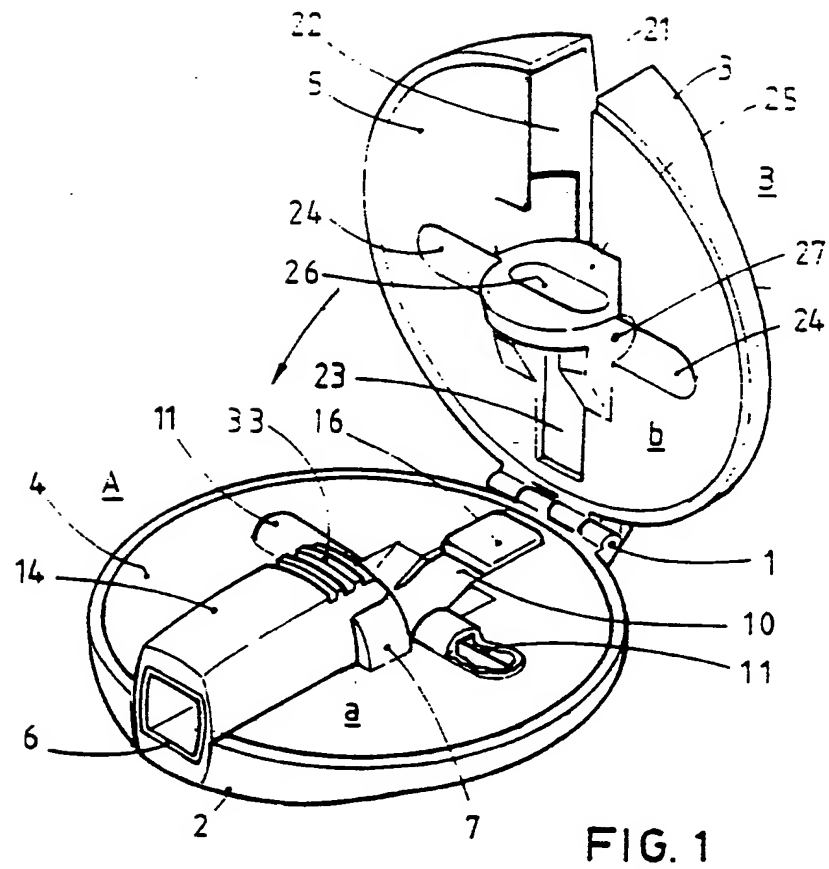
4. A device according to claims 2 and 3, characterized in that the  
15 piercing needle is located in the the pivot axis containing center plane of the mouth piece and housed in that part of the device that comprises the stationary section of the mouth piece and the mixing chamber, whereas the slidable section of the mouth piece carries a U-shaped connecting piece having leg portions located on either side of  
20 the mixing chamber and a bridge portion that extends behind said bottom section and carries said ejecting member, the latter being tongue shaped.

5. A device according to claims 2-4, characterized in that the mouth piece and the mixing chamber are making part of a supporting  
25 plate laying substantially in a center plane of said mouth piece and mixing chamber, said support plate just fitting within the circumferential edge of a shell-shaped box portion, whereas the bottom section is making part of a second support plate laying substantially in a center plane of said bottom section and just fitting within the  
30 circumferential edge of a second shell-shaped box portion, that is connected with said first box portion via said laterally positioned pivot axis, in such a way that the two support plates are resting one onto the other when the box is closed.

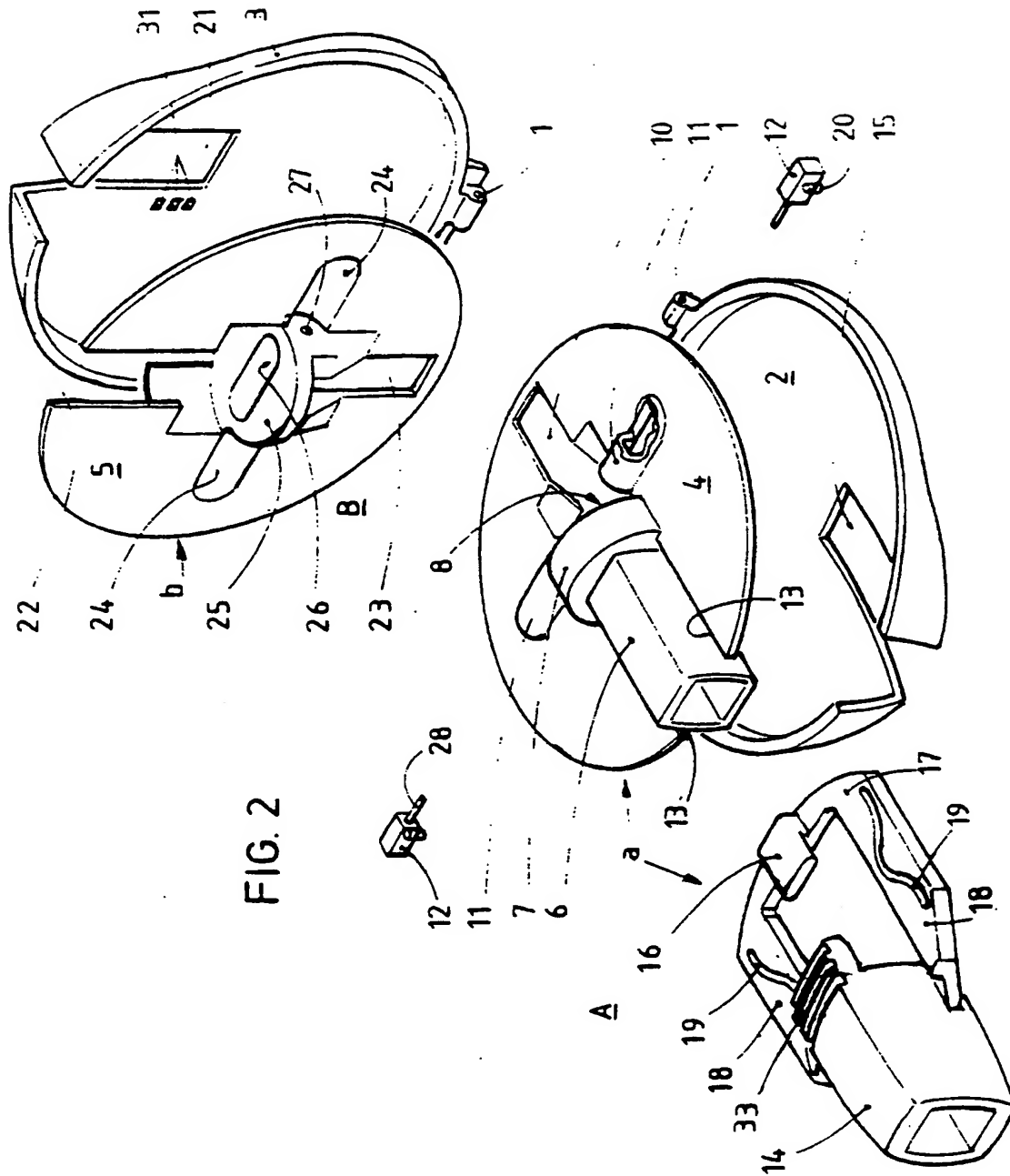
6. A device according to claim 5, characterized in that recesses  
35 are provided in said two shell portions, through which the mouth piece wall portions, which extend on both sides of said center plane, may project outwardly.

7. A device according to claims 5-6, characterized in that in those zones of the support plates which are located beyond said mouth piece

and bottom sections, recesses are provided for receiving supply capsules.



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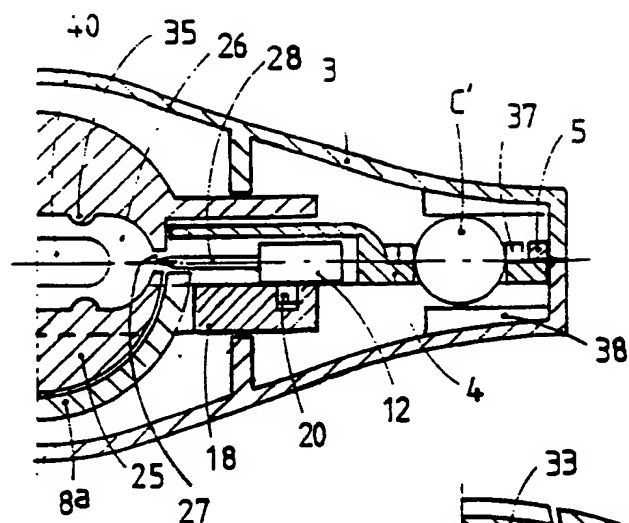


FIG. 4

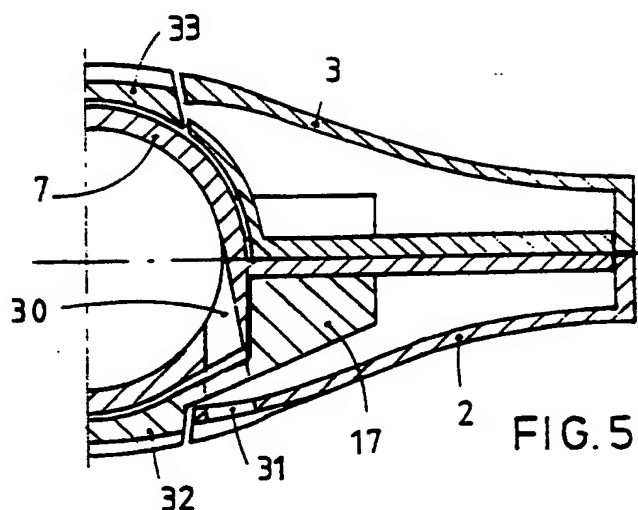


FIG. 5

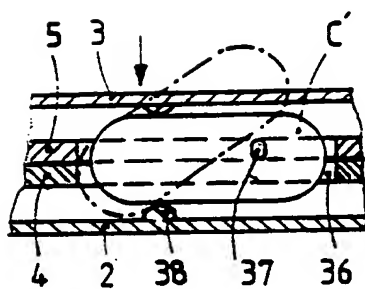


FIG. 6

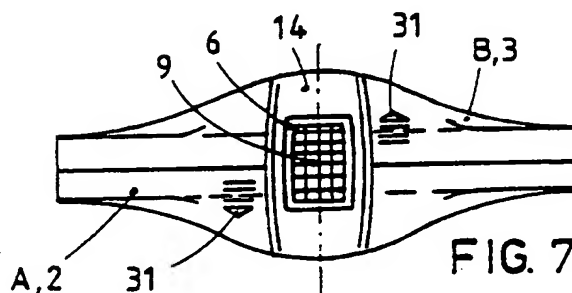


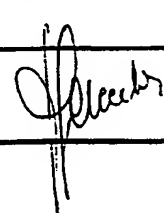
FIG. 7

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## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/NL 91/00259

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 A61M15/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	A61M	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	DE,A,2 704 574 (ALLEN&HANBURYS LTD) 11 August 1977 see page 5, line 3 - page 7, line 20; figures 1-3	1,2
A	FR,A,2 264 563 (I.S.F.) 17 October 1975 see page 3, line 30 - page 5, line 2; figures & NL,C,176 837 22 September 1975 cited in the application & NL,C,179 345 1 February 1985 cited in the application	1,2
A	EP,A,0 005 585 (FISONS LTD) 28 November 1979 see page 7, line 14 - page 9, line 5; figures	1,2
A	US,A,2 517 482 (V.HALL) 9 April 1949 see column 2, line 16 - column 3, line 62; figures	1,2
-/-		
<p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
09 MARCH 1992	24. 03. 92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	VEREECKE A. 	



III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		Relevant to Claim No.
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	
A	WO, A, 8 907 464 (HARRIS PHARMACEUTICALS LTD) 24 August 1989 see page 7, line 26 - page 8, line 23; figures ---	1

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO. NL 9100259  
SA 54682**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the European Patent Office EDP file on  
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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